

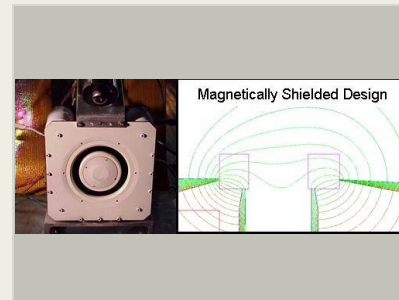
# Wide Throttling, High Throughput Hall Thruster for Science and Exploration Missions, Phase II

Completed Technology Project (2013 - 2015)



## Project Introduction

In response to Topic S3.04 "Propulsion Systems," Busek Co. Inc. will develop a high throughput Hall effect thruster with a nominal peak power of 1-kW and wide throttling range in terms of both power and Isp. In Phase I the preliminary thruster design was completed. Project activities focused on achieving a magnetic field that shields the discharge channel from ion induced erosion. The goal is to achieve a propellant throughput greater than 100 kg/kW. Numerical modeling is playing a critical role in the thruster design. In Phase I, we used a fluid based code developed by JPL to model the plasma in an existing thruster that is currently undergoing life testing. The erosion predictions of the model were found to agree well with actual measurements. The numerical model was then applied to the magnetically shielded 1-kW thruster and preliminary results were found to be reasonable. The goal is to demonstrate a thruster design where channel erosion is entirely eliminated as a life limiting mechanism. In Phase II, we will build and test the extended lifetime thruster. The performance, lifetime, and plume properties of the thruster will then be evaluated, and the design will be optimized. Numerical modeling will be used throughout the process to ensure that magnetic shielding is achieved. Code predictions will be grounded in plasma measurements taken with a variety of diagnostics including channel wall probes, high speed intrusive channel probes, and plume probes. The ability of the thruster to achieve its lifetime goals will be assessed through a 500 hour wear test. When the design is finalized, an engineering development unit (EDU) thruster will be designed, built, validated, and delivered to NASA. The EDU thruster design will be modeled thermally and structurally to facilitate the transition to Phase III. At the end of the Phase II, the TRL will be 5/6.

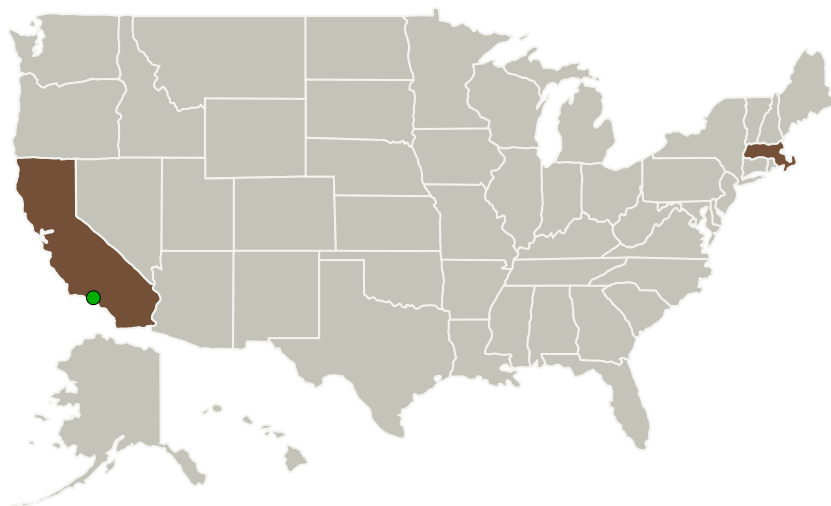


Wide Throttling, High Throughput Hall Thruster for Science and Exploration Missions Project Image

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## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Busek Company, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Natick, Massachusetts
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

## Primary U.S. Work Locations

California	Massachusetts
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## Project Transitions

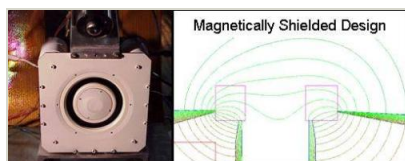
▶ **January 2013:** Project Start

✓ **March 2015:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137300>)

## Images



### Project Image

Wide Throttling, High Throughput Hall Thruster for Science and Exploration Missions Project Image (<https://techport.nasa.gov/image/126956>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Busek Company, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Lawrence T Byrne

### Co-Investigator:

Lawrence Byrne

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## Technology Maturity (TRL)

Start: **3**  
Current: **5**  
Estimated End: **5**



## Technology Areas

### Primary:

- TX01 Propulsion Systems
  - └ TX01.2 Electric Space Propulsion
    - └ TX01.2.2 Electrostatic

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System